

## CLAIMS

1. A method for depositing a material on a surface of a wafer, comprising:  
applying an electroless plating solution to the surface of the wafer, the electroless  
plating solution being maintained at a temperature at which a plating reaction does not  
5 readily occur; and

exposing the surface of the wafer to radiant energy, the radiant energy being  
capable of increasing a temperature of the surface of the wafer to a state at which the  
plating reaction occurs at an interface between the surface of the wafer and the electroless  
plating solution.

10

2. A method for depositing a material on a surface of a wafer as recited in  
claim 1, further comprising:

controlling a wavelength range of the radiant energy to cause the radiant energy to  
selectively heat a material present at the surface of the wafer.

15

3. A method for depositing a material on a surface of a wafer as recited in  
claim 2, further comprising:

monitoring conditions at the surface of the wafer to ensure that the wavelength  
range of the radiant energy is established to selectively heat the material present at the  
20 surface of the wafer.

4. A method for depositing a material on a surface of a wafer as recited in  
claim 3, wherein the conditions at the surface of the wafer include a surface material type,  
a surface material thickness, and a surface material temperature.

5. A method for depositing a material on a surface of a wafer as recited in claim 1, wherein exposing the surface of the wafer to radiant energy is performed by pulsing the radiant energy.

5

6. A method for depositing a material on a surface of a wafer as recited in claim 5, wherein a pulse of the radiant energy is defined to have a duration within a range extending from about 1 millisecond to about 500 milliseconds.

10 7. A method for depositing a material on a surface of a wafer as recited in claim 5, further comprising:

allowing the electroless plating solution to quench the surface of the wafer between pulses of the radiant energy.

15 8. A method for depositing a material on a surface of a wafer as recited in claim 1, further comprising:

collimating the radiant energy prior to exposing the surface of the wafer to the radiant energy.

20 9. A method for depositing a material on a surface of a wafer as recited in claim 8, further comprising:

scanning the collimated radiant energy over the wafer, wherein the scanning causes the surface of the wafer to be exposed to the radiant energy in a substantially uniform manner.

10. A method for depositing a material on a surface of a wafer as recited in claim 1, further comprising:

controlling the temperature of the electroless plating solution to be substantially  
5 lower than the temperature at which the plating reaction occurs.

11. A method for depositing a material on a surface of a wafer as recited in claim 1, wherein the electroless plating solution is applied to the surface of the wafer by submerging the wafer in a bath of the electroless plating solution.

10

12. A method for depositing a material on a surface of a wafer as recited in claim 11, wherein the surface of the wafer is exposed to the radiant energy while being submerged in the bath of the electroless plating solution.

15 13. A method for depositing a material on a surface of a wafer as recited in claim 11, further comprising:

removing the wafer from the bath of the electroless plating solution, wherein the surface of the wafer is exposed to the radiant energy immediately upon removal from the bath of the electroless plating solution.

20

14. A method for depositing a material on a surface of a wafer as recited in claim 13, wherein a sequence of submerging the wafer in the bath of the electroless plating solution and removing the wafer from the bath of the electroless plating solution is

performed repeatedly until a desired amount of material is deposited on the surface of the wafer.

15. A method for depositing a material on a surface of a wafer as recited in  
5 claim 13, wherein submerging the wafer in the bath of the electroless plating solution and removing the wafer from the bath of the electroless plating solution is performed by rotating a portion of the wafer through the bath of the electroless plating solution.

16. A method for depositing a material on a surface of a wafer as recited in  
10 claim 11, further comprising:  
flowing the electroless plating solution over the surface of the wafer.

17. A method for depositing a material on a surface of a wafer as recited in  
claim 11, further comprising:  
15 oscillating the wafer while exposing the surface of the wafer to the radiant energy.

18. A method for depositing a material on a surface of a wafer as recited in  
claim 1, further comprising:  
enclosing the wafer within a vessel containing the electroless plating solution.

20

19. A method for depositing a material on a surface of a wafer as recited in  
claim 18, further comprising:

increasing a pressure of the electroless plating solution contained within the vessel, wherein increasing the pressure increases a density of nucleation sites at which the plating reaction occurs.

5           20.     A method for depositing a material on a surface of a wafer as recited in claim 18, further comprising:

transmitting the radiant energy through a wall of the vessel to expose the surface of the wafer to the radiant energy.

10           21.     A method for depositing a material on a surface of a wafer as recited in claim 1, wherein the surface of the wafer is exposed to the radiant energy in a substantially uniform manner resulting in a substantially uniform material deposition over the surface of the wafer.

15           22.     A method for depositing a material on a surface of a wafer as recited in claim 1, wherein exposing the surface of the wafer to radiant energy includes transmitting the radiant energy through the wafer to reach the surface of the wafer.

20           23.     An apparatus for depositing a material on a surface of a wafer, comprising:  
a tank defined by an enclosing wall and a bottom, the tank being configured to contain an electroless plating solution;

a wafer support structure disposed within the tank, the wafer support structure being configured to support a wafer at a submerged position within the electroless plating solution to be contained within the tank; and

a radiant energy source disposed above the wafer support structure, the radiant energy source being oriented to direct radiant energy toward the wafer to be supported at the submerged position within the electroless plating solution.

5           24.     An apparatus for depositing a material on a surface of a wafer as recited in claim 23, wherein the radiant energy source is configured to generate radiant energy having a wavelength range that is capable of selectively heating a material present at a surface of the wafer upon which the radiant energy will be incident.

10           25.     An apparatus for depositing a material on a surface of a wafer as recited in claim 23, wherein the radiant energy source is configured to apply a substantially uniform amount of the radiant energy over the surface of the wafer.

              26.     An apparatus for depositing a material on a surface of a wafer as recited in  
15 claim 25, wherein the radiant energy source is stationary.

              27.     An apparatus for depositing a material on a surface of a wafer as recited in claim 25, wherein the radiant energy source is configured to collimate the radiant energy, the radiant energy source being further configured to be scanned over the surface of the  
20 wafer.

              28.     An apparatus for depositing a material on a surface of a wafer as recited in claim 23, wherein the wafer support structure is configured to oscillate the wafer.

29. An apparatus for depositing a material on a surface of a wafer as recited in claim 23, further comprising:

an inlet for supplying the electroless plating solution to the tank; and

an outlet for removing the electroless plating solution from the tank.

5

30. An apparatus for depositing a material on a surface of a wafer as recited in claim 23, further comprising:

a heat exchanger capable of maintaining a temperature of the electroless plating solution to be contained within the tank.

10

31. An apparatus for depositing a material on a surface of a wafer, comprising:

a vessel defined by a top, a bottom, and an enclosing wall, the vessel being configured to contain an electroless plating solution;

a wafer support structure disposed within the vessel, the wafer support structure being configured to support a wafer at a position within the vessel; and

a radiant energy source disposed above the wafer support structure, the radiant energy source being oriented to direct radiant energy toward the wafer to be supported within the vessel.

20

32. An apparatus for depositing a material on a surface of a wafer as recited in claim 31, wherein the radiant energy source is disposed outside the vessel, the vessel being composed of a material capable of transmitting radiant energy emitted from the radiant energy source to an interior of the vessel.

33. An apparatus for depositing a material on a surface of a wafer as recited in claim 31, wherein the radiant energy source is disposed within the vessel.

34. An apparatus for depositing a material on a surface of a wafer as recited in claim 31, wherein the radiant energy source is configured to generate radiant energy having a wavelength range that is capable of selectively heating a material present at a surface of the wafer upon which the radiant energy will be incident.

35. An apparatus for depositing a material on a surface of a wafer as recited in claim 31, wherein the radiant energy source is configured to apply a substantially uniform amount of the radiant energy over the surface of the wafer.

36. An apparatus for depositing a material on a surface of a wafer as recited in claim 31, wherein the radiant energy source is stationary.

15

37. An apparatus for depositing a material on a surface of a wafer as recited in claim 31, wherein the radiant energy source is configured to collimate the radiant energy, the radiant energy source being further configured to be scanned over the surface of the wafer.

20

38. An apparatus for depositing a material on a surface of a wafer as recited in claim 31, wherein the wafer support structure is configured to oscillate the wafer.

39. An apparatus for depositing a material on a surface of a wafer as recited in claim 31, further comprising:

a pressure control capable of controlling a pressure of the electroless plating solution to be contained within the vessel.

5

40. An apparatus for depositing a material on a surface of a wafer as recited in claim 31, further comprising:

an inlet for supplying the electroless plating solution to the vessel; and

an outlet for removing the electroless plating solution from the vessel.

10

41. An apparatus for depositing a material on a surface of a wafer as recited in claim 31, further comprising:

a heat exchanger capable of maintaining a temperature of the electroless plating solution to be contained within the vessel.

15

42. An apparatus for depositing a material on a surface of a wafer, comprising:

a tank defined by an enclosing wall and a bottom, the tank being configured to contain an electroless plating solution;

a wafer holder configured to dip a wafer into the electroless plating solution to be contained within the tank, the wafer holder further configured to remove the wafer from the electroless plating solution to be contained within the tank; and

a radiant energy source disposed above the electroless plating solution to be contained within the tank, the radiant energy source being oriented to direct radiant energy

toward the wafer upon removal of the wafer from the electroless plating solution to be contained within the tank.

43. An apparatus for depositing a material on a surface of a wafer as recited in  
5 claim 42, wherein the radiant energy source is configured to generate radiant energy having a wavelength range that is capable of selectively heating a material present at a surface of the wafer upon which the radiant energy will be incident.

44. An apparatus for depositing a material on a surface of a wafer as recited in  
10 claim 42, wherein the radiant energy source is configured to apply a substantially uniform amount of the radiant energy over the surface of the wafer.

45. An apparatus for depositing a material on a surface of a wafer as recited in  
claim 42, further comprising:  
15 an inlet for supplying the electroless plating solution to the tank; and  
an outlet for removing the electroless plating solution from the tank.

46. An apparatus for depositing a material on a surface of a wafer as recited in  
claim 42, further comprising:  
20 a heat exchanger capable of maintaining a temperature of the electroless plating solution to be contained within the tank.

47. An apparatus for depositing a material on a surface of a wafer, comprising:

a tank defined by an enclosing wall and a bottom, the tank being configured to contain an electroless plating solution;

a wafer holder configured to rotate a portion of the wafer through the electroless plating solution to be contained within the tank; and

5 a radiant energy source disposed above the electroless plating solution to be contained within the tank, the radiant energy source being oriented to direct radiant energy toward the portion of the wafer upon rotation out of the electroless plating solution to be contained within the tank.

10 48. An apparatus for depositing a material on a surface of a wafer as recited in claim 47, wherein the radiant energy source is configured to generate radiant energy having a wavelength range that is capable of selectively heating a material present at a surface of the wafer upon which the radiant energy will be incident.

15 49. An apparatus for depositing a material on a surface of a wafer as recited in claim 47, wherein the radiant energy source is configured to apply a substantially uniform amount of the radiant energy over the surface of the wafer.

20 50. An apparatus for depositing a material on a surface of a wafer as recited in claim 47, further comprising:

an inlet for supplying the electroless plating solution to the tank; and

an outlet for removing the electroless plating solution from the tank.

51. An apparatus for depositing a material on a surface of a wafer as recited in claim 47, further comprising:

a heat exchanger capable of maintaining a temperature of the electroless plating solution to be contained within the tank.

5

52. An apparatus for depositing a material on a surface of a wafer, comprising:

a tank defined by an enclosing wall and a bottom, the tank being configured to contain an electroless plating solution;

a wafer support structure disposed within the tank, the wafer support structure  
10 being configured to support a wafer at a submerged position within the electroless plating solution to be contained within the tank; and

a radiant energy source disposed within the wafer support structure, the radiant energy source being oriented to direct radiant energy toward a bottom surface of the wafer to be supported at the submerged position within the electroless plating solution, the  
15 radiant energy being capable of traversing through the wafer to heat a material present on a top surface of the wafer.